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environmental assessment
replace sentinel bridge

SENTINEL BRIDGE
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environmental assessment
replace sentinel bridge – pkg 370

july 1989

SENTINEL BRIDGE
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UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

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I. PURPOSE OF AND NEED FOR ACTION

The National Park Service is proposing to replace Sentinel Bridge, one of the crossings of the Merced River in Yosemite Valley. A Federal Highways Administration (FHWA) inspection in May 1987 estimated the remaining life of the bridge as two years. The bridge is structurally unsafe for today's highway loads and continues to deteriorate because of concrete breaking off that exposes the reinforcing steel. The 20-foot travel lane width (two 10-foot-wide lanes) is below the NPS standard for the traffic volumes the bridge carries. A primary consideration is the width necessary to safely accommodate vehicles other than automobiles. Twenty percent of park visitors travel in some kind of recreational vehicle, frequently driven by inexperienced drivers. Shuttle and tour buses and concessioner trams use the bridge. Bicycle traffic must share the narrow roadway with other vehicle traffic.

Since it was constructed in its present location, the bridge has been a popular location for viewing and photographing Half Dome because it offers an unobstructed view and a reflection in the water. Pedestrians create a traffic hazard by moving off the narrow sidewalk into the roadway to avoid photographic equipment set up on the sidewalk. The 3-foot-wide sidewalks are below standard width for wheelchair accessibility.

The four support piers in the river and the abutments which extend into the river beyond the existing stream bank constrict the flow of the Merced River. High water erodes around the bases of the piers and abutments.

The combination of the clear water of the Merced River and high air temperatures during the peak visitation season is inviting. Visitors jump from the bridge even though the park discourages this practice. Jumping from the bridge attracts onlookers, which creates congestion and accident potential by distracting motorists' attention. The existing guardrails are insufficient to discourage visitors from climbing on and jumping from the bridge into the river.

The present parking area, which holds approximately 20 cars and pickups, is inadequate to accommodate demand, particularly on Sunday when it is used as overflow parking by people attending services in the Chapel. Parking spaces are not delineated, which results in disorganization and inefficient use of the available space.

This document evaluates the environmental consequences of constructing a new bridge upstream of the existing Sentinel Bridge, removing the present bridge, and redesigning the existing parking area. The No-Action alternative is also evaluated.

II. ALTERNATIVES

ALTERNATIVE 1: NO ACTION

Under this alternative, the existing bridge and parking area would be retained. No provisions would be made for bicyclists, pedestrian traffic, or oversize vehicles beyond what currently exists. The width of the bridge would remain substandard for the traffic volumes. A safety hazard would continue to exist because of the mixing of motor vehicle traffic and bicycles on the narrow bridge, because of visitors jumping from the bridge into the river, and because narrow sidewalks force pedestrians into the roadway on occasion. The sidewalks do not meet federal handicapped accessibility standards.

The bridge would become increasingly inadequate and substandard as visitation and associated traffic volumes increase. Structural deterioration would continue, and the bridge would have to be closed to vehicle traffic. The bridge piers would continue to be undermined by the Merced River. The piers and abutments would continue to constrict the river flows.

ALTERNATIVE 2 (PREFERRED): CONSTRUCT A NEW BRIDGE 160 FEET UPSTREAM OF EXISTING BRIDGE AND REMOVE EXISTING BRIDGE

Description of the Proposal

The preferred alternative is to construct a new flat arch masonry veneer concrete bridge 160 feet upstream of the existing bridge. The existing bridge would be removed after the new bridge is opened to vehicle traffic. The dimensions of the new bridge were derived from *Park Road Standards* and from discussions with the park staff concerning dimensions necessary to accommodate traffic volume and visitor use (see Preferred Alternative drawing). The length of the proposed span would be 110 feet. The bridge abutments would be out of the river channel. There would be no piers in the water. The new bridge would have two 15-foot-wide travel lanes for vehicle and bicycle traffic, and a pedestrian sidewalk on each side. The downstream (west) sidewalk would be five feet wide, and the upstream (east) sidewalk would be eight feet wide. The triangular upper edge of the guardwall and guardrail on the bridge would discourage visitors from standing on the guardwall and jumping from the bridge (see Preferred Alternative - Finished Appearance of Bridge figure).

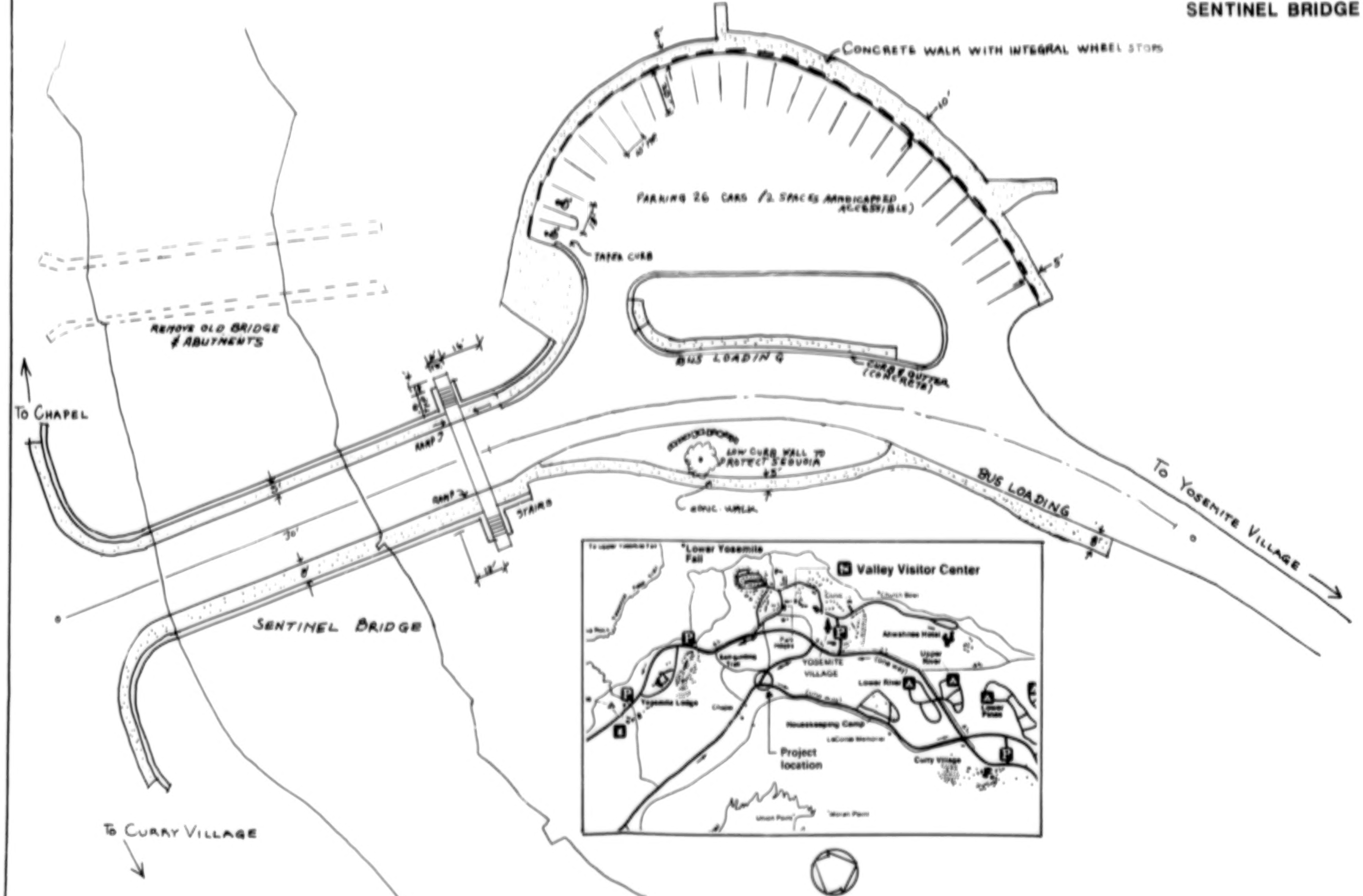
The existing parking area on the north side of the bridge would be redesigned within the limits of the existing disturbed area as a pull-through lot with an island for traffic control and snow storage. Twenty-six delineated parking spaces for passenger cars and/or pickup trucks, including two reserved handicapped spaces, would be provided around the perimeter of the lot. Oversize vehicles and tour buses would park in the center of the lot parallel to the island. The island would be designed to allow for plantings to partially screen it from the road.

Shuttle bus loading zones would be located on both sides of the roadway at the north end of the bridge. The roadway would be widened at the bus stops to allow for passenger loading out of the roadway. The southbound bus stop would be near the exit at the south end of the parking lot. When the parking lot is too congested for a shuttle bus to negotiate the stop, the shuttle would stop next to the island in a widened portion of the roadway. This stop and its connection to the bridge sidewalk would be made handicapped accessible.

The bridge sidewalks would have ramps at each end to make them handicapped-accessible. A 5-foot-wide pedestrian path would be built adjacent to the roadway to connect the northbound bus stop with the bridge sidewalk. A crosswalk would be marked at the north end

PREFERRED ALTERNATIVE

SENTINEL BRIDGE AND PARKING



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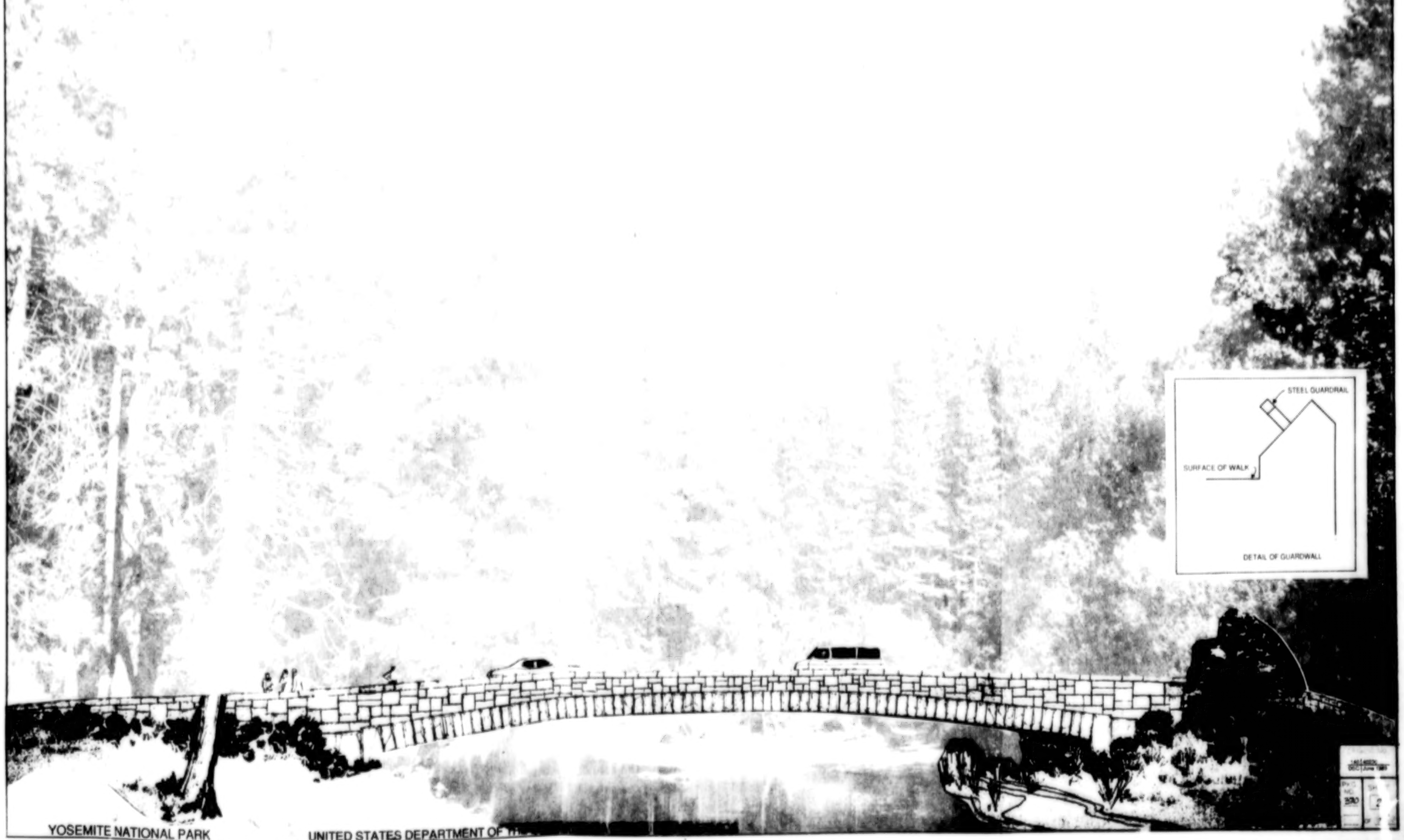
PREFERRED ALTERNATIVE
PROPOSED SENTINEL BRIDGE



YOSEMITE NATIONAL PARK

UNITED STATES DEPARTMENT OF

of the bridge to indicate the access point from the downstream sidewalk and parking lot/shuttle bus stop to the upstream sidewalk. Stairs would be built on both sides at the north end of the bridge to provide access (not handicapped access) to the unmaintained social trails which have developed along the river bank, without people having to walk around the end of the bridge. There are no intentions at this time to formalize these trails. If a formal trail system was built eventually, the stairs would be replaced with handicapped accessible structures.

Following construction of the new bridge, the old bridge and approaches would be removed. The site would be restored and regraded to simulate the original contours, and revegetated using native, indigenous species. A stream flow gauge on the existing bridge would be kept in place until a new gauge is calibrated and installed on the new bridge.

ALTERNATIVES CONSIDERED BUT REJECTED

Four design objectives guided the development of the preferred alternative. Traffic disruption and congestion on the Valley road system had to be minimized. The amount of new disturbance had to be kept to a minimum, with no disturbance to the adjacent meadow. The view of Half Dome from the bridge had to be maintained. And, the above criteria had to be met in the safest way possible.

Repair the Existing Bridge

FHWA determined that strengthening the bridge would be extremely difficult, expensive, and would radically alter the appearance. FHWA believed that, due to the nature of the original design, it was unlikely that a complete restoration and prevention of continued deterioration was possible. Because the cost of restoration would exceed the cost of a new structure, FHWA recommended replacement rather than repair. The Park Service concurred.

Remove the Bridge with No Replacement

The bridge and its associated road would be removed and the site restored. This alternative was rejected because it would result in increased traffic congestion in other parts of the Valley due to removal of the busiest river crossing in the Valley and because the view of Half Dome from the bridge would be lost.

Replace the Bridge at a Location other than the Preferred Alternative

The decision was made to locate the replacement structure in the general area of the existing structure based on long-range planning and transportation studies done for the Yosemite Valley/El Portal Comprehensive Design, and based on the need to perpetuate the view of Half Dome. Five alternative locations within the general area of the present bridge, including the existing site, were considered before selecting the preferred alternative described previously.

Present Site: The old bridge would be removed and the new bridge constructed on the same site. This alternative was rejected because it would not allow adequate space for redesign of the parking area without impacts to the adjacent meadow. This alternative would not have met the objective of minimizing traffic disruption. Either traffic would have been diverted to another river crossing for two construction seasons (one season to remove the old bridge and one season to build the new one), thus increasing congestion in other parts of the Valley, or a temporary river crossing would have had to be constructed.

Upstream 200 yards: A new bridge would be constructed 200 yards upstream of the present site, near the bend in the river. This location was rejected because a wetland would have been impacted, and because it would have resulted in a long span requiring center supports that constrict the river.

Upstream 100 yards: A new bridge would be constructed 100 yards upstream of the present site. This location was rejected because it would have required excessive vegetation clearing to allow vehicle operators to see approaching traffic, and because an archeological site was present.

Upstream 60 yards: A new bridge would be constructed 60 yards upstream of the present site. A 40-inch diameter at breast height (dbh) sequoia tree lies in this proposed bridge alignment. An archeological site lies directly in this alignment. This alternative location was rejected to avoid removal of the sequoia tree and to avoid major impacts to the archeological site.

Finished Appearance of Bridge

Several designs were prepared for the external finish on the basic flat concrete arch structure. The first alternative was an all-concrete structure, with a finish somewhere between a sand finish and a stucco texture finish. The lines of the arch were reinforced by grooves formed into the concrete parallel with the coping and more or less parallel with the inner surface of the arch. The second alternative was a concrete structure similar to the first in which the articulation of the arch and the top line of the bridge was accomplished with bands of masonry veneer. Both these alternatives were rejected because the finishes did not blend in with the existing Valley architecture.

Parking Area

The redesigned parking area would be constructed within the limits of the existing parking area to avoid additional disturbance to the extent possible, particularly to the adjacent meadow to the northwest. One alternative proposed that the parking lot have a single entrance with no island. That configuration of the lot maximized auto\pickup parking spaces but was rejected because it did not provide parking or adequate maneuvering room for oversize vehicles and trailers.

III. AFFECTED ENVIRONMENT

EXISTING CONDITIONS

The existing bridge is a reinforced concrete girder and floor beam bridge, 96 feet long and 28 feet wide, with two 10-foot-wide travel lanes and 3-foot-wide sidewalks on each side. There are four reinforced concrete piers in the river and abutments extending into the river beyond the existing bank. A parking area that holds about 20 vehicles in undelineated spaces is located north of the bridge on the west side of the road. On Sundays, the lot is used as overflow parking by people attending services in the chapel. The parking area is also used as a bus stop for shuttle buses and commercial tour buses.

Traffic Volumes: The traffic volumes for Sentinel Bridge are comparable to many urban situations. The Average Annual Daily Traffic (AADT) for Sentinel Bridge Road, adjusted for 1986 based on 1984 figures, is 2894 vehicles. The average daily traffic during one week in mid-July, 1984, the high visitation season, was 5273. The AADT, the volume of traffic averaged over a 24-hour period for a year, is a statistic which measures the level of vehicle use for a road. Application of the design standards from *Park Road Standards*, particularly width standards, is heavily dependent on actual use data.

Oversize vehicles such as commercial buses, park shuttle buses, large recreational vehicles, commercial truck-trailer rigs, concessioner trams, heavy construction equipment, fire trucks, and NPS snow removal equipment use Sentinel Bridge. The Federal Government and the State of California have approved a 6 inch increase in the width of commercial tour buses to 102 inches. These larger vehicles are already on the park roads.

Circulation Patterns: The bridge carries Sentinel Bridge Road, a 0.32 mile two-way road connecting the Southside Drive section of the Valley Loop Road with Northside Drive at the Bank 4-way intersection just south of Yosemite Village. Sentinel Bridge Road allows direct access to the Yosemite Village development to the north.

The Valley Loop Road (Southside and Northside Drives) provides an internal circulation system for Yosemite Valley. Southside Drive is two-lane, one-way eastbound running along the south bank of the Merced River. Northside Drive is a two-lane, two-way road where it intersects Sentinel Bridge Road. It becomes a two-lane, one-way westbound road past the gas station at Yosemite Lodge and exits the Valley along the north bank of the river.

Access: Access to the Valley is via California State Highway 41 to the South Entrance and Wawona from the south, California 120 to Big Oak Flat Entrance from the northwest and Tioga Pass Entrance from the east, and California 140 to El Portal and the Arch Rock Entrance from the west. At the park boundaries, the state highways become park entrance roads. Except for the Tioga Road, the entrance roads join the Valley Loop Road in the western part of the Valley several miles downstream from Sentinel Bridge.

Other Valley Bridges: In addition to Sentinel Bridge, three other bridges which are open to visitor vehicle traffic cross the Merced River to connect Northside Drive to Southside Drive. Pohono Bridge, the westernmost crossing of the Merced River in the Valley, is about 7 miles downstream from Sentinel Bridge. El Capitan Crossover is between Pohono and Sentinel bridges. Stoneman Bridge is upstream of Sentinel Bridge. Sentinel Bridge receives the greatest traffic (AADT 2894), followed by Stoneman (2550), Pohono (2525), and El Capitan (648) bridges.

Visitor Use: In 1988, over 3.3 million people visited Yosemite National Park. Visitation has increased annually since 1982; between 1971 and 1982, increases alternated with decreases. About three-quarters of all park visitors come to Yosemite Valley. Although the park receives visitors from around the world, the majority come from the San Francisco and Los Angeles metropolitan areas, a 4-8 hour drive away. The peak season is May through September, with the greatest visitation on the Memorial Day, Fourth of July, and Labor Day weekends.

Accident History: A traffic safety improvement study identified Sentinel Bridge Road as a high motor vehicle accident location based on analysis of reported accidents from 1981 to mid-1984. The bridge and a short segment of road past the parking area ranked 13 of 18 such locations in the park. The accidents varied widely with regard to cause (a deer, a horse, a bicycle, driver error, driver under the influence, snowy pavement, excessive speed).

CULTURAL RESOURCES

Archeological Resources

Evidence of human occupation in the Yosemite area is believed to date back over 3000 years. The Central and Southern Miwok were the major groups inhabiting the area historically and protohistorically, with other groups present sporadically. Both permanent villages and seasonal hunting camps have been found on the Valley floor. Native American occupation has continued through historic times. The project location does not contain any resource or value significant to contemporary Native American peoples.

The project is located within the boundaries of the Yosemite Valley Archeological District, which is listed on the National Register of Historic Places. The Park Archeologist has identified an archeological site (CA-MRP-79) on the south side of the existing bridge adjacent to Southside Drive. There is also an archeological site (CA-MRP-902) upstream on the north side of the river adjacent to the proposed location of the replacement bridge. These two sites are either listed or eligible to be listed on the National Register by virtue of their being within the Yosemite Valley Archeological District.

Historical Resources

There has been a succession of river crossings at the site of the existing bridge. The first bridge was a crude log structure erected in 1859 by Gustavus Adolphus Hite. J.M. Hutchings replaced it with a better log bridge in 1865. All Valley bridges were swept away by high water in the floods of 1867-68. Hutchings replaced his log bridge with a finished timber bridge with a superstructure. In 1878, the State of California replaced that with an all-metal, steel-arched truss bridge. It was refurbished in 1898 and used until 1918. A new concrete bridge was completed in 1919. Sentinel Bridge was evaluated in 1979 for possible inclusion on the National Register of Historic Places. Because the existing bridge (the 1919 concrete structure) was extensively reconstructed in 1960-61, it was determined to be ineligible for listing on the National Register.

Northeast of the present bridge is the site of the Chris Jorgensen cottage, which was moved to the Pioneer Yosemite History Center at Wawona. The site itself is not historically significant. The Yosemite Valley Chapel, located about one quarter mile south of the bridge off Southside Drive, is listed on the National Register of Historic Places. There are no other historic properties in the vicinity of the bridge that are listed, eligible, or proposed for listing on the National Register.

NATURAL RESOURCES

Detailed information on natural resources in Yosemite National Park may be found in the 1978 *Draft* (DEIS-GMP) and the 1980 *Final Environmental Impact Statements* (FEIS-GMP) of the Yosemite *General Management Plan* (GMP). A summary of the natural resources affected by this project follows.

Climate: Yosemite Valley, at 4,000 feet elevation, is characterized by cool, mild winters and hot, dry summers. The Valley receives 37 inches of annual precipitation, one-third as snow. More than half the total precipitation falls in December, January, and February. The average daily temperatures during July range from 50-90 degrees F., and from 23-45 degrees F. in January. Winter construction work is possible during most years.

Geology/Physiography: Yosemite Valley is a typical U-shaped, glacier-carved valley. Perpendicular walls rise an average of 3,000 feet on either side of a level valley floor. Potential geologic hazards include mudslides, rockfalls, and rock tumble zones along the sides of the Valley. The project site is on flat valley floor with no known geological hazards.

Soils: Soils in the Valley are derived from the area's granite bedrock. Drainage areas consist of alluvium, boulders, and cobbles. There are three soil types in the project area. The soil in the stream channel is a sandy alluvium. The soil on the north bank is a recent floodplain deposit, Leidig loamy very fine sand (siliceous igneous intrusive). The south bank is colluvial Sentinel cobbly loamy sand. Soil limitations is this area could include poor drainage, a seasonally high water table, soft sand, and stoniness. The FHWA will prepare a soils geotechnical report. Based on a preliminary evaluation by FHWA, no significant soils limitations which may alter the project are anticipated at this time.

Air Quality: Air quality in Yosemite National Park is designated Class I, indicating the lowest allowable increments of degradation. Vehicular emissions from traffic in the Valley contribute nitrates, hydrocarbons, and carbon monoxide to the air. Campfire smoke also contributes particulate matter to the air.

Water Resources: Surface Waters – The Merced River and its tributaries, part of the San Joaquin River Basin, form the major drainage system in Yosemite Valley. The watershed that feeds the Merced is approximately 1,280 square miles. The upper reach of the river originates on the west slope of Mt. Lyell (13,114 feet elev.), east of the Valley. Major tributaries upstream of the project site include Illilouette and Tenaya Creeks. The river flows from east to west through the Valley, making sweeping meanders within its floodplain.

The Merced River is characterized by marked seasonal variation in volume. The amount and duration of streamflow is directly affected by the snowpack and the rate of snowmelt. Streamflow is highest during spring runoff. High volume flows generally occur between mid-April and July, low flows during September and October. The US Geological Survey (USGS) has operated a stream gauge downstream at Pohono Bridge since 1916. Two major tributary streams, Yosemite Creek and Bridalveil Creek, enter the river below the project site but above the stream gauge at Pohono Bridge. The highest flow recorded at Pohono Bridge was 23,400 cubic feet per second (cfs) during December, 1955. The minimum average monthly discharge was 7.38 cfs recorded during September 1977.

The streambed in the vicinity of Sentinel Bridge is coarse sand, gravel, and cobbles, depending on the season and water flow level. The river is a few feet deep in the project vicinity at low flows.

Water Quality: The exact water quality at the project site itself cannot be quantified at this time due to lack of data. Results of water quality analyses conducted on the Merced River may be found in the 1978 DEIS-GMP, and in the 1984 and 1985 reports of the US Fish and Wildlife Service (USFWS) on instream flow studies. According to the GMP and the 1983 Environmental Assessment prepared for the rehabilitation of the Yosemite Valley water system, the surface water quality of the Merced River and associated tributaries is generally considered good for most beneficial uses defined by the California State Water Resources Control Board. In the project area, these uses include wildlife habitat, cold freshwater habitat, noncontact recreation, canoeing and rafting, and water contact recreation. Water quality testing at El Portal, 13 miles downstream of the project site, indicated that fluctuations in water quality are associated with seasonal changes in river volume. A USFWS study of the suitability of the river as rainbow trout habitat determined that water temperatures were generally suitable but occasionally deviated above optimum for holding adults and juvenile rearing stages during low flows. Other water quality parameters (dissolved oxygen, carbon dioxide, pH, alkalinity, turbidity) and general overall quality were considered satisfactory for trout habitat.

Stream Erosion: Lateral streambank erosion is less severe on straight stretches of river such as in the project vicinity than at river bends. Although it is not possible to quantify the amount of erosion that occurs at Sentinel Bridge, there is erosion at the bases of the piers and around the abutments, which project into the river beyond the existing bank. The streambanks in the project area have a sparse vegetative cover that provides limited erosion protection. There is old riprap along both banks upstream of the existing bridge, including the proposed new location.

Milestone (1978) states that the constriction of the river by a bridge is responsible for scouring a deeper hole beneath the bridge than would exist if no constriction were present. The pool depth under the existing bridge was measured at 7 feet in October, 1977.

Floodplain: The project site lies in the 100-year floodplain of the Merced River. Major damaging floods in the Valley were recorded in 1867, 1871, 1890, 1919, 1937, 1950, 1955, 1963, and 1964. As measured downstream of the project site at Pohono Bridge, the 1937, 1950, and 1955 floods were 100-year floods. The 1963 flood was a 10-year flood, and the 1964 flood was a 50-year flood. The flood level was not determined for the earlier floods. Of the 1867 flood, Hutchings (1886) described "the whole meadow land of the Valley covered by a surging and impetuous flood to an average depth of nine feet."

Wetlands: There are no wetlands in the project area. There is a wetland upstream, but it is not within the boundaries of the project as proposed.

Wild and Scenic River Values: The main stem of the Merced River within Yosemite National Park was designated as a component of the National Wild and Scenic River System in 1987 (P.L. 100-149). Such designation is intended to preserve the river in the state in which it existed at the time of designation. The Valley reach of the Merced River in the project area will be classified as a Recreational River. Replacement of existing stream crossings such as Sentinel Bridge is compatible with Wild and Scenic River status. The river is used for rafting, kayaking, floating, swimming, wading, and angling.

Vegetation: Vegetation in the project area is a mixture of riparian immediately adjacent to the river bank and mixed conifer in the rest of the site. The riparian component is primarily willow and alder trees. Dominant elements of the mixed conifer vegetation type in the project area are incense cedar and ponderosa pine. There is a meadow immediately adjacent to the west side of the existing parking area. Although it is not native to the Valley, a 40-inch dbh sequoia tree is present northeast of the proposed bridge alignment.

Root rot fungus (*Heterobasidion annosum*) is a major pathogen of coniferous trees in Yosemite Valley. It infects trees through the roots or when the bark is cut or abraded. Such injury is common in construction zones and helps spread the fungus and accelerate tree loss.

Wildlife: Wildlife in the project area is typical of the mixed conifer zone of the Sierra Nevada. California ground squirrels, chipmunks, Douglas' squirrels, raccoons, skunks, coyotes, gray foxes, and mule deer are common mammals that occur near the project site. Birds include rufous hummingbirds, belted kingfishers, common flickers, acorn woodpeckers, flycatchers, violet-green swallows, Steller's jays, mountain chickadees, red-breasted nuthatches, brown creepers, water ouzels, robins, warblers, Brewer's blackbirds, Western tanagers, black-headed grosbeaks, dark-eyed juncos, and sparrows. Garter snakes, western fence lizards, alligator lizards, and mountain king snakes are typical reptiles. The main aquatic wildlife are rainbow trout, brown trout, Sacramento suckers, and various invertebrates.

Threatened and Endangered Flora and Fauna: There are no known federally or state listed, proposed, or candidate threatened or endangered plant species located in the project area. No known federally or state listed, proposed, or candidate threatened or endangered animal species permanently inhabit or breed within the project area. There is no known critical habitat in the project area.

Scenic Resources: Among the most important scenic features visible from the project site (or very close by) are Half Dome, Yosemite Falls, Three Brothers, Royal Arches, Glacier Point, Sentinel Rock, North Dome, and Bridalveil Falls.

IMPACTS OF ALTERNATIVES 1 and 2

Impacts of Alternative 1: No Action

The bridge supports would continue to be weakened from stream erosion. The structure would continue to deteriorate and would eventually have to be closed to protect visitor safety. The width would continue to be below NPS standards for bridges that carry that volume of traffic. Conflicts between vehicles, bicyclists, and pedestrians on the narrow bridge would continue, with attendant safety problems. Conflicts would increase as visitation increases. Visitors would continue to climb on the railings and jump from the bridge. The bridge would continue to be unsafe and only marginally accessible to handicapped visitors. Congestion and inefficient use of the parking area would continue.

Under this alternative, there would be no impact on scenic values or visitor enjoyment of the scenery. Visitor use of the river would not be interrupted by construction. There would be no impacts associated with construction (temporary decreases in air or water quality, construction delays and noise, and visual intrusion). The bridge would continue to constrict the flow of the Merced River, which would lead to a deepening of the hole beneath the bridge following high water and floods. There would be no additional impact to threatened and endangered species, wetlands, Wild and Scenic River values, vegetation, wildlife, soils, air or water quality, or cultural resources.

Impacts of Alternative 2 (Preferred): Construct a New Bridge 160 Feet Upstream of the Existing Bridge and Remove Existing Bridge

Impacts on Visual Resources: There would be a temporary negative impact on photography and viewing of Half Dome from the existing bridge until the new bridge is opened to foot traffic. The Half Dome view from the old bridge would be impaired for one construction season because the construction site would be upstream from the existing bridge. There would be no change in the view of Half Dome from the new bridge.

The newly constructed bridge would not detract aesthetically from the scenic qualities of the Merced River. The masonry facing of the new bridge would be visually compatible with the surroundings and other Valley bridges and architectural precedents. There would be a minor increase in the total amount of visual intrusion attributable to the larger size of the new bridge and the area required for approaches.

Impacts on Traffic, Visitor Use, and Visitor Safety: The old bridge would be left in place and operational until the new bridge is finished, so no detours or alternate river crossings would be necessary. Short construction delays would occur during reconstruction of the parking area and when the new approaches are merged into the existing road alignment. Traffic eastbound on Southside Drive towards Camp Curry and the campgrounds would be affected by delays when the south approach is merged into Southside Drive. Both north and southbound traffic on Sentinel Bridge Road would experience short delays when the north approach is merged into Sentinel Bridge Road. Since the construction site is at a major intersection, the delays could cause considerable congestion during periods of heavy visitation. To partially mitigate traffic congestion, merging the approaches with the existing roads would be scheduled for periods of low visitation. Signing and traffic control would be required on both sides of the river.

The existing bridge has a summer weekend traffic volume of over 5000 vehicles. The proposed 15-foot-wide lanes meet the NPS minimum standard for roads of that volume and are sufficient to meet the needs of traffic operations. Traffic flow would be improved because of the added width of the new bridge. The addition of 5 feet to the existing width of each lane would adequately accommodate bicycles without adding separate bike lanes. Pedestrian safety would be improved because the 8-foot-wide upstream sidewalk would allow pedestrians and visitors in wheelchairs to pass photographers with camera equipment set up on the walk.

Visitor safety would be improved by the guardwall and guardrail that discourage jumping from the bridge. Traffic flow would improve because drivers would not be distracted by people jumping from the bridge.

Impacts due to reconstruction of the parking area would be limited to the existing disturbed area. The parking area would be closed during reconstruction, which would increase congestion slightly in other parking areas and cause inconvenience to visitors who want to park close to the bridge. Lack of overflow parking for the chapel would cause inconvenience for some visitors while the lot is closed. Six additional parking spaces for a total of twenty-six would be available for cars and pickup trucks following construction, which would partially alleviate the demand. Handicapped accessibility to the bridge would be increases by reserving two spaces closest to the bridge. Delineation of spaces would provide organization lacking in the present "uncontrolled" parking area. Auto parking would be eliminated at a future date if autos are eventually eliminated from the Valley.

There would be an increase in the use of the unmaintained social trails along the riverbank in the immediate vicinity of the bridge due to increased ease of access because of the stairs. It is not possible to determine the exact degree of increased use.

The bridge would meet federal handicapped accessibility standards. One function of the bridge is to provide a view of Half Dome. Handicapped accessibility to this function has been provided with reserved parking, ramps, a crosswalk, and wide sidewalks.

Impacts on Cultural Resources: Bridge construction would not have additional impacts on the archeological site on the south bank of the river that has already been disturbed by Southside Drive. There would be impacts to the site on the north bank from grading and slopework, and from the presence of heavy equipment; mitigative archeological excavation is scheduled for the summer of 1989. The planned archeological data recovery project would be designed in consultation with the California State Office of Historic Preservation.

Because the project is situated within an archeological district, there is a possibility that grading may expose unknown cultural deposits. Avoidance or mitigative data recovery in consultation with the State Historic Preservation Office would be required if impacts to archeological sites cannot be avoided.

There would be no impact to historical structures listed on, or proposed or eligible for listing on the National Register.

Impacts to Soils: Approximately 0.5 acre of previously undisturbed ground would be graded and paved. About 0.2 acre would be restored and revegetated. An area on the north side of the bridge where the bridge approach meets the existing road would be filled to a depth of approximately 1.5 feet above the existing grade to construct approaches. Fill materials would come from outside the park. Six temporary piles would be driven into the streambank on each side to support construction scaffolding. Soils within the project construction limits would be trampled and compacted by the presence of construction equipment and workers. Some petrochemicals from construction equipment would seep into the soil, with a resultant loss of soil microorganisms. Soils would be disturbed for removal of the existing bridge. Disturbed soils would be susceptible to erosion until revegetation takes place. There would be a minor increase (0.3 acre) in the total disturbed area due to the larger size of the new bridge and the area required for the alignment of the new portion of the road with the established road.

A corrugated steel coffer dam would be erected on each streambank surrounding the area where the abutment would be constructed. The coffer dams would prevent runoff of streambank material into the river and maintain a relatively dry area for construction of abutments. Approximately 1000 cubic yards would be excavated from each streambank behind the coffer dams for construction of abutments. Following construction of abutments and wingwalls, the area would be backfilled to the approximate level of the existing grade. Excess excavated material would be disposed of outside the park. Permanent pilings (steel cylinders filled with concrete) would be driven along the outside edges of the excavated area to support the abutment footings; the depth to which the piles would be driven cannot be determined yet. The size of the piles would be determined following soil testing.

There would be a localized increase in streambed and streambank erosion during those phases of construction which involve the streambank and instream work (installation and removal of temporary piers for scaffolding support, installation and removal of coffer dams, and removal of existing bridge abutments and center piers). Streambank erosion would continue until the disturbed area is stabilized and revegetated. There would be no need for riprapping or construction of an embankment at the new bridge site because the new bridge would span the river without abutments in the water. The hole beneath the bridge would deepen from the scouring action of floods of a volume sufficient to be constricted by the bridge, but it is not possible to determine exactly how much scouring will occur.

Erosion and soil compaction of the streamside social trails would increase to the degree that there is increased use of the trails due to increased ease of access because of the stairs. It is not possible to determine the degree of increase of either use or erosion and compaction. Impacts would be mitigated by site design and revegetation to direct visitor use to the least sensitive areas. The scar of the old bridge site would be an appropriate area.

Impacts on Air and Water Quality: There would be no long-term impacts to air quality. Local air quality would temporarily decrease due to fumes from construction equipment. Traffic delays would cause slight temporary decreases in local air quality due to fumes and emissions from idling vehicles. Surface-disturbing activities would cause temporary increases in dust and particulate matter. To partially mitigate this impact, such activity would be coupled with water sprinkling to reduce dust. There would be a temporary increase in noise from construction. The impacts of noise and decreased air quality on large numbers of visitors can be partially mitigated by timing of construction to occur during the low-visitation seasons.

There would be no long-term impacts to water quality. The FHWA would obtain a U.S. Army Corps of Engineers 404 permit prior to construction. Instream work such as pier removal would proceed in as short a time as possible to minimize river bottom disturbance. Instream work would be done during low flow periods to minimize the sediment load put into the river. The coffer dams would prevent or partially mitigate siltation of the river downstream during construction of abutments. Sediment traps would be installed to prevent deterioration of water quality downstream from the construction site during removal of the existing piers. Because the soils in the area are derived primarily from sand, sedimentation is usually minimal. There would be temporary minor decreases in water quality (turbidity) due to increased sediment runoff from erosion of newly disturbed soil, and possible runoff of petrochemicals from construction equipment. Petrochemical traps would be used to mitigate seepage into the river. Water quality would be maintained at or above minimum levels required by the State of California Water Quality Control Board.

Impacts to A Floodplain: The National Park Service guidelines for implementing Executive Order 11988 (Floodplains Management) identify bridge construction as an action excepted from compliance with E.O. 11988. The bridge would continue to be a barrier to free stream flow during the 100-year flood on the Merced River, but it is not practical to construct a bridge that is above the elevation of the 100-year flood. The bridge would be designed to withstand the hydraulic forces of overflow. The design of the replacement structure with no center piers or abutments to constrict stream flow or affect channel conditions offers an improvement over the existing bridge under most flow conditions. Over the long term, the constriction would preclude future lateral streambed movement (meander development). The masonry retaining walls of the existing bridge abutments would be removed to reduce the existing constriction of the river.

Impacts to a Wild and Scenic River: Over the long term, bridge construction would not degrade those qualities for which the Merced River was designated Wild and Scenic. Thirty-two temporary piles would be driven into the streambed as a temporary support for scaffolding and forms during construction of the new bridge. The piles would be removed following construction and the holes filled with clean gravel imported from outside the park. There would be a short-term impact from construction on the recreational qualities of the river. Rafting, kayaking, floating, and angling in the vicinity of the bridge would be stopped or disrupted during construction of the replacement bridge and removal of the existing bridge. Some visitors would be frustrated by this closure. They would be required to get out of the water and move around the construction site if they wished to continue their trip down the river. Warning signs and a barrier across the water would be erected upstream of the construction site to prevent access to the site by visitors using the river. The barrier would not be in the water and therefore would allow water passage and would not impede wildlife movements.

Impacts on Vegetation: Approximately 18 incense cedar and ponderosa pine trees, measuring 4 inches to 42 inches dbh, would be removed. Stumps would be removed to prevent slumping of the pavement. If stumps are not removed, they would be flush cut and treated with sodium tetraborate decahydrate to prevent infection with root rot spores. Some riparian vegetation, primarily alder and willow trees approximately 30 feet tall, would be removed from the south bank. Ground vegetation, primarily grasses, herbaceous vegetation, and shrubs, would be removed to construct the bridge abutments and approaches.

The alignment of the new bridge is adjacent to a sequoia tree. A low rock wall would be constructed around the tree. The wall would allow avoidance of the tree and its rooting area during construction. Until the rock wall is constructed, fencing would be used to protect the tree from abrasion by earth-moving equipment. Some of the rooting area of the tree would be covered by asphalt paving, but no long-term damage to the tree is anticipated.

Trees adjacent to the site which would not be removed have the potential to be damaged by construction equipment. Measures would be taken to prevent infection of damaged trees by root rot spores. If trees are abraded, the abrasions would be treated within a few hours with sodium tetraborate decahydrate to prevent root rot infection.

A fence would be placed around the western perimeter of the project site adjacent to the meadow to prevent trampling and compaction of the meadow soils and vegetation during construction.

Following removal of the existing bridge, the site would be restored to as natural a condition as possible. Approximately 0.2 acre of previously disturbed ground would require restoration. The area from which the existing bridge abutments are removed would be graded to the natural contours which existed before the bridge.

Revegetation of the old bridge site and the newly disturbed area, and the plantings on the parking area island would be required to proceed in accordance with the guidelines established by the park Resource Management staff. Vegetation removed during construction would be salvaged to the greatest extent possible for use in restoring areas disturbed on this project. To protect the genetic integrity of the park stocks, species used in revegetation must be native species endemic to the park. Seed sources and species used must be approved by the park staff. Exotic plant species are a problem in the Valley because of the amount of disturbance, and would quickly colonize the construction site. To control possible introduction of exotic plants, sterile soil or soils from the parent area would be used as fill. Revegetation would proceed as soon as possible to decrease the time available for colonization by exotic plants. Provisions would be made for removal by hand of exotic species that may germinate in the disturbed areas in the first year after construction prior to revegetation. Streambank revegetation to increase erosional resistance would be part of the revegetation prescription for this project.

Streamside vegetation in the vicinity of the unmaintained social trails would be trampled by visitors using the trails. It is not possible to determine the degree of trampling. Impacts to streamside vegetation would be mitigated in the same manner as impacts to streambanks - by confining visitor use to a limited area and directing that use to the least sensitive areas.

Impacts on Wildlife: There would be a temporary decrease in habitat quality for all wildlife due to noise and activity during construction. The majority of wildlife would move out of the area during construction activities and recolonize after construction. Some burrowing and soil-dwelling organisms would be destroyed by earth-moving activities.

The standing trees removed would constitute loss of habitat for birds and rodents. The carrying capacity of the immediate area would be slightly reduced with respect to these animals, but the overall habitat loss in terms of the larger Valley area would be negligible. Vegetation removal would be timed to occur so that it has the least impact to wildlife, particularly the spring nesting season for birds.

No permanent negative impacts on aquatic wildlife are anticipated. The suitability of the river as trout habitat and habitat for the endemic aquatic invertebrates would decrease if turbidity increased significantly over several months. The increase would have to be greater and sustained longer than that which occurs naturally during high water and floods. Such an increase in turbidity due to construction is not anticipated. The removal of the existing bridge piers will reduce the amount of cover available to trout. Substrate-dwelling invertebrates would be displaced and some would be destroyed during pier removal. Disturbance of the streambed for pier removal would cause a short-term increase in local food availability for trout as stream invertebrates are dislodged. Trout may congregate downstream of the construction site to take advantage of this food source. Trout habitat will be improved to the extent that the shadow of the wider new bridge would provide more shade (overhead cover), which is favored by trout for resting. The impact of more shade on other aquatic organisms is unknown but no major negative impacts are anticipated. Fish spawning grounds in the project area would be checked prior to construction to determine whether or not they are close enough to the project site to be directly impacted by instream work, or indirectly impacted through increased sedimentation and turbidity. Since instream work would occur during low-flow periods that generally occur in the fall, the fall-spawning brown trout would be the species most likely to be affected although no adverse impacts to spawning grounds are anticipated. Disturbance of gravel suitable for trout spawning would be avoided if possible. If large amounts of gravel have to be removed, the gravel would be saved and replaced following construction.

Impacts to Threatened and Endangered Species: No known federally or state listed, proposed, or candidate threatened or endangered plant or animal species or critical habitat would be impacted by this project. Clearance has been obtained from the USFWS.

TABLE 1 - IMPACTS OF ALTERNATIVES

	Alternative 1 No Action	**Alternative 2 Replace Bridge**
Socioeconomic Environment		
Visitor experience	view of Half Dome	temporary severe impact on view of Half Dome from old bridge until new bridge opens; temporary inconvenience from construction delays
Pedestrian safety	visitors jump from bridge; move into traffic lane to avoid photographers	guardrail discourages jumping; sidewalks accommodate all users
Bicycle safety	lanes too narrow for vehicles and bicycles	5 feet additional width for bicycles
Oversize vehicle safety	substandard width for wide vehicles	width added to meet NPS standards
NPS road standards	substandard	meets standards
Construction impact	no impact	temporary delays, noise, dust
Traffic flow	greater congestion as visitation increases	improved with widening
Parking	capacity exceeded during high use periods and Sundays	increase from 20 to 26 spaces for cars & pickups; 2 spaces reserved for handicapped users; some congestion relief; some visitor frustration during lot closure during construction
Cultural Resources		
Archeological resources	no additional impact	no additional impact to site on south bank; impacts to site on north bank scheduled for mitigation in 1989
Historical resources	no impact	no impact

	Alternative 1 No Action	Alternative 2 Replace Bridge
Natural Resources		
Topography	no impact	0.5 acre graded & filled; 0.2 acre recontoured
Soils	compacted by visitors using area	compacted by visitors & construction equipment & personnel; 0.5 acre to be graded and paved; 0.2 acre to be restored and revegetated; soils disturbed for placement of temporary piers and coffer dams; 2,000 cubic yards excavated for abutment construction; some backfill around abutments; increased erosion until revegetation completed; streamside trails compacted by visitor use
Air Quality	no impact	minor temporary local degradation due to dust and fumes; partial mitigation by water sprinkling
Water quality	no impact	minor temporary local degradation from erosion of unrevegetated soils; possible petrochemical seepage or runoff; mitigated by sediment trap, petrochemical trap, and coffer dams
Floodplain	bridge supports weakened by floodwaters	excepted action; bridge built to withstand floodwaters; lateral migration of streambed restricted
Wild and scenic river values	no impact	angling, rafting, tubing, kayaking temporarily disrupted in vicinity of project during construction; no long-term impact
Threatened & endangered species	no impact	no impact

	Alternative 1 **No Action**	**Alternative 2** **Replace Bridge**
Vegetation	no impact	18 conifer trees, minor amount ground vegetation removed; revegetation required for 0.2 acre and streambank; streamside vegetation trampled by visitors using streamside trails
Terrestrial wildlife	no impact	temporary decrease in habitat quality during construction; minor habitat loss (trees); burrowing and soil- dwelling organisms lost
Aquatic wildlife	no additional impact	disturbance during instream work; some invertebrates lost
Wetlands	no impact	no impact
Streambed/ streambank erosion	erosion at piers and abutments during most flow levels	temporary increase during removal of existing bridge piers and abutments, and installation/removal of support piers; decrease after removal of bridge piers; slight increase in erosion of streamside trails from visitor use
Water flow	constricted by piers and abutments	constriction restricted to floodwaters; constriction an improvement over existing bridge

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As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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